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Geological History of the West Gippsland Region

By J. J. Jenkin*

Abstract: In the known geological history of the West Gippsland Region the first events were the development of a geosyncline in the early Palaeozoic and its contraction in the Silurian and Devonian. A major orogeny occurred in the late Middle Devonian and granites were intruded in the late Upper Devonian. Then followed a long hiatus which extended from the Devonian to at least late in the Jurassic.

During the Lower Cretaceous the Eastern Highlands were uplifted and depositional troughs developed to the south. A period of earth movement and erosion followed and, in the early Tertiary, the deposition of clastic sediments and thin coals. Then followed extensive volcanic activity which was in turn succeeded by the deposition of a major coal measure sequence.

Towards the end of the coal measure phase marine transgression occurred, commencing in the Oligocene and reaching its maximum in the Miocene. Regression of the shoreline followed in the late Miocene and Pliocene, with terrestrial deposition again becoming dominant in the later Pliocene.

It was at this stage that the gross topographic form of the present terrain was determined by earth movements along largely pre-existing structures.

The final modifications producing the topographic detail of today are closely related to fluctuations in sea level and climate during the Pleistocene and Recent. These exerted a marked control on erosion and deposition, both terrestrial and marine. Thus the broad physiographic outlines of West Gippsland are morphotectonic in origin, but have been modified by marine and terrestrial erosional and depositional processes.

INTRODUCTION

The West Gippsland Region is an area of complex and varied geology, all aspects of which cannot be considered within the limits of a short review. Consequently this contribution has been limited to an attempt to show how certain geological events which have taken place since Cambrian times have influenced the development of the present terrain (Table 1).

Outstanding amongst the earlier workers on the geology of the Region are A. R. C. Selwyn (1855) and R. A. F. Murray (1876) who provided a sound basis, in Western Port and South-west Gippsland respectively, on which later contributions have been built. It may be of interest to note that Selwyn's mapping, carried out under very difficult and arduous conditions, was more accurate in many respects than some of the later work. Errors appeared in maps published in the 1890s and were perpetuated in many later maps, a point which did not become apparent until the area was remapped in the early 1960s.

Space would not allow a complete review of the voluminous literature on West Gippsland, but several outstanding contributions come to mind. These include the work on the brown coals by Herman (1922), Thomas and Baragwanath (1949-50) and Gloe (1960), the petrological studies on the Older Volcanics by Edwards (1938), The account of Hills (1942) of the physiography of the Kooweerup Swamp and, more recently, the detailed work of Douglas (1969) on the Mesozoic floras. The reviews by Singleton of the geology of Victoria (1965, 1967a) and of South Gippsland (1967b) are also of particular interest.

THE PALAEOZOIC FRAMEWORK

The Palaeozoic, from the Cambrian to the Upper Devonian, was a time of exclusively marine deposition and volcanic activity in West Gippsland culminating in a major orogeny in the late Middle Devonian and extensive granitic intrusions in the Upper Devonian. These various Palaeozoic episodes are here very briefly described.

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Cambrian Volcanic Activity

During the Cambrian vast quantities of basic lavas, with associated tuffs and agglomerates, were extruded. These have been altered (mainly by serpentinization) to a varying extent and are often referred to as 'greenstones'. Ropy flow surfaces and features resembling pillows have been recorded locally. Lenses of chert and shale containing sponge spicules, as well as minor lenses of dark crystalline limestone, are interbedded with the lavas (Lindner, 1953).

These volcanics are thus partly marine and may be entirely so. Although they occur at one locality only within the Region (Waratah Bay) they are of widespread occurrence in Victoria, principally along major structural axes, for example in the Wellington-Barkly area (Harris and Thomas, 1954). It is suggested that this volcanic activity was associated with the initiation of the geosynclinal conditions which became so strongly established in the Ordovician.

The tuffs and shales of Middle to Upper Cambrian age often found overlying the greenstones elsewhere in Victoria are absent at Waratah Bay.

Ordovician Geosynclinal Development

During the Ordovician a thick series of alternating graded greywackes and shales was deposited under geosynclinal and anaerobic conditions (Singleton, 1965, 1967a). However, at Waratah Bay and in the Mornington Peninsula, two exceptions to this general uniformity are found.

At Waratah Bay there occurs the only conspicuously calcareous facies in the Victorian Ordovician, that is, the Digger Island Limestone of early Ordovician age. The lower part of the formation consists of grey crystalline limestone, followed by brown decalcified mudstones, then by shales and muddy limestones. The estimated thickness is about 120 ft (Lindner, 1953). The only fossil found in the crystalline limestone is an indeterminate nautiloid, but the brown mudstones have yielded well-preserved trilobites, and the upper beds an 'orthid' brachiopod fauna (Singleton, 1967b).

In the Mornington Peninsula the Ordovician sequence is somewhat condensed, but appears to be complete from the Lancefieldian La2 zone (La1, if present, is not exposed) to the Upper Ordovician. The sequence is also atypical in that it includes the Kangerong Formation, lying between the La2 and La3 zones of the Lower Ordovician, with a lithology reminiscent of the Silurian siltstones and sandstones and completely devoid of dark graptolitic shale.

The Ordovician zones are arranged concentric-

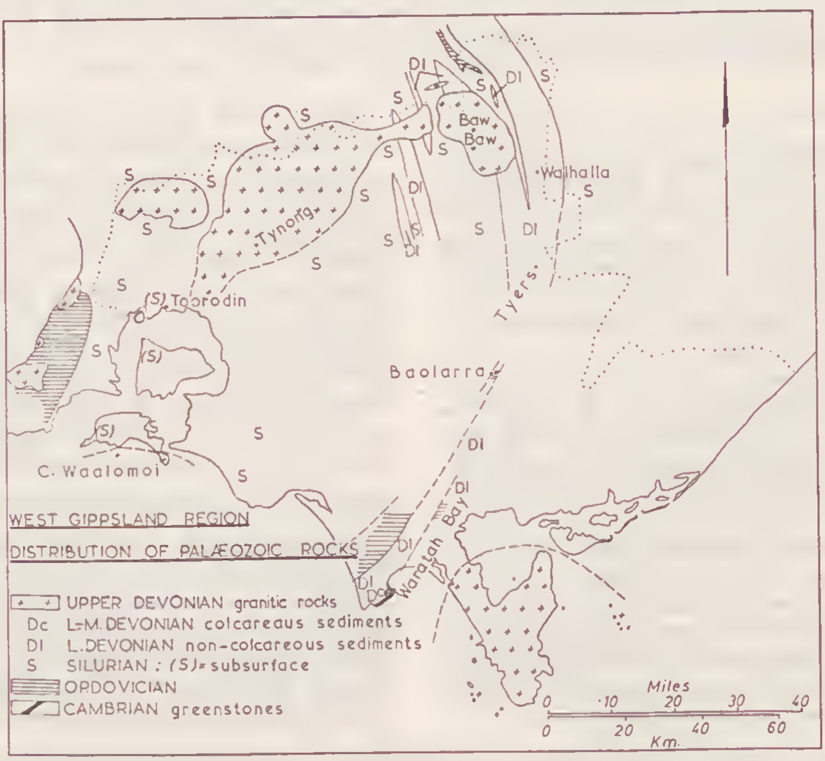

Fig. 1

West Gippsland Region—Geological Events

	Mornington Peninsula and Western Port	South Gippsland Highlands and Waratah Bay	Central Highlands	Gippsland Basin
QUATERNARY Recent	Alluvium of present flood plains. Beach ridge, dune and shallow marine deposits		Low-level alluvium	Alluvium of present flood plains. Beach ridge, dune and shallow marine deposits.
Pleistocene	High-level alluvium Beach ridge, dune, lagoonal and shallow marine deposits.		High-level alluvium	High-level alluvium. Beach ridge, dune and lagoonal deposits.
	UNCONFORMITY		UNCONFORMITY	
	Warneet Formation		Haunted Hill Gravels	Haunted Hill Gravels
TERTIARY	Grantville Gravels	Gravels		
	UNCONFORMITY	KOSCIUSKO EARTH MOVEMENTS		UNCONFORMITY
Pliocene	Fresh-water clastic sediments, marine silt.			Boisdale Beds Jemmy's Point Formation LOCAL EARTH MOVEMENTS
Miocene	Baxter Sandstone Sherwood Marl			Gippsland Limestone
Oligocene	Clastic sediments, carbonaceous in part			Lakes Entrance Formation LOCAL UNCONFORMITIES Upper Latrobe Valley Coal Measures
	LOCAL UNCONFORMITIES			LOCAL UNCONFORMITIES
Eocene Paleocene	Basic volcanics and clastic sediments	Thorpdale Volcanics Childers Formation		Lower Latrobe Valley Coal Measures: Including Thorpdale Volcanics, Childers Formation.
	UNCONFORMITY		UNCONFORMITY	
CRETACEOUS Lower	Strzelecki Group = Korumburra Group		Tyers Group	Strzelecki Group
	UNCONFORMITY		UNCONFORMITY	
JURASSIC TRIASSIC PERMIAN				
CARBONIFEROUS			Conglomerates, sandstones, volcanics &c. Granitic rocks	
DEVONIAN Upper	Granitic rocks, acid volcanics	Granitic rocks, Wilson's Promontory		
		TABBERABBERAN	OROGENY	
Middle Lower		Bell Point Limestone Liptrap Formation Waratah Limestone	Centennial Beds Deep Creek Limestone	
SILURIAN	Sandstones, mudstones and subgreywackes		Sandstones, mudstones and subgreywackes.	
ORDOVICIAN Upper	Subgreywackes, shales and slates, frequently cherty	Subgreywackes, shales and slates.		
Middle Lower: Yapeenian Castlemainian Chewtonian Bendigonian Lancefieldian	Incl. Kangerong Formation	Digger Island Limestone		
		UNCONFORMITY		
CAMBRIAN		Altered basic volcanics ("greenstones") with minor sediments.		

Table 1

ally around an elongate dome which occupies the west-central part of the Peninsula. The presence of the Kangerong Formation, which is approximately 3,000 ft thick, suggests a shallowing of the sea at this time in the early Ordovician which may be related to an early stage in the establishment of the Mornington structural axis.

Ordovician rocks also outcrop to the west of the Waratah axis, as a small inlier near Boolarra, and as a narrow belt in the axis of the Mt. Easton anticlinorium. However, the area of outcrop of Ordovician rocks within the Region is small (Fig. 1).

Silurian and Devonian Sedimentation

The close of the Ordovician coincided with a marked change in the nature of the sediments deposited, and in the form of the depositional trough, which became confined between the Mt. Wellington axis on the east and the Heathcote and Mornington axes on the west. At the same time the water became shallower, ripplemark and cross-bedding being quite common, with graded bedding of less frequent occurrence than in the Ordovician sediments.

Lithological changes also appear at the beginning of the Silurian. Subgreywackes are still present in places but siltstones and claystones are dominant while clean sandstones, often fine-grained, are common (Singleton, 1965, 1967a). Bed thickness varies more widely than in the Ordovician rocks and ranges from finely-laminated shale to massive mudstones with individual beds many feet thick. Conglomerates also occur, particularly towards the top of the sequence, as lenses within finer-grained sediments or as persistent bands. In the northern part of the Region occasional lenses of limestone occur within the thick succession of dominantly non-calcareous rocks, for example at Cooper's Creek on the Thomson River.

Deposition persisted throughout the Silurian and Lower Devonian and, despite the change in conditions, followed the Ordovician without an obvious break. The sequence is therefore apparently conformable from at least the early Ordovician to the top of the Lower Devonian.

As Singleton (1967a) points out, neritic shelly faunas, virtually absent from the Ordovician, become progressively more conspicuous through the Silurian and Lower Devonian. Deposition was predominantly neritic although local areas of deeper water, in which dark shales accumulated, occurred from time to time: for example the distinctive *Monograptus-Baragwanathia* shales. In general however, graptolites occur spasmodically in the Siluro-Devonian in contrast to their persistent and widespread presence in the Ordovician.

Two features of the Lower Devonian in the eastern part of the depositional trough are of particular significance. These are firstly, the widespread occurrence of land plants in the clastic, otherwise marine, sediments which suggests the presence of a land area immediately to the east; and secondly, the development of the Waratah and Bell Point Limestones in the Waratah Bay area (Lindner 1953, Teichert 1954, Talent 1965). The occurrence of these calcareous sediments in the vicinity of the Waratah axis suggests the presence of a structural high and probable shoal area. Probably at the same time, mudstones and sandstones of the Liptrap Formation were deposited in the deeper water on the flanks of the axis. This is reminiscent of conditions in this area during the early Ordovician and suggests that intermittent movements occurred along the Waratah axis over a long period.

Middle Devonian Orogeny

Deposition ceased in the late Lower to early Middle Devonian, probably due to the onset of a major phase of deformation, known as the Tabberabberan orogeny, which reached its peak in the late Middle Devonian (Talent, 1965). The strongest effect was produced in the north-east of the Region where all the sediments, including the Lower Devonian, were closely folded. Over the remainder of the area the older rocks tend to be more intensely folded than the younger. This suggests that the older beds may have started to crumple in the subsiding trough while the younger beds were still being deposited, the folding being completed by this phase of intense tectonic activity in the Middle Devonian.

Devonian Igneous Activity

Following the Tabberabberan orogeny, or perhaps during its dying phase, innumerable dykes, known as the Woods Point dyke swarm, were intruded into the folded sediments, particularly along the west limb of the Walhalla synclinorium (Hills, 1952). The trend of the dykes coincides broadly with the strike of the containing sediments and they have not been affected by the folding although they have been cut by numerous relatively small faults. Auriferous quartz veins often occupy these faults as well as occurring along the walls of the dykes. The dykes range from quartz porphyry to peridotite in composition but diorite and lamprophyre predominate.

Further igneous activity, in the form of large discordant intrusions of granitic rocks, took place in the late Devonian. These include the Baw Baw, Lysterfield, Mt. Eliza and Mt. Martha granodiorites, and the Tynong, Cape Woolamai, Wilsons Promontory and Dromana granites (Fig. 1). Within the Region these rocks have intruded and locally metamorphosed sediments as young as Lower Devonian. In neighbouring areas, for example at the southern end of the Dandenong Ranges, granitic rocks intrude volcanics of Upper Devonian age. They are therefore regarded as being very late or Epi-Devonian in age.

MESOZOIC TECTONICS AND SEDIMENTATION

The pre-Cretaceous Surface

Although no sediments of Upper Devonian to at least mid-Jurassic age are represented in the Region, an extensive belt of Devono-Carboniferous sediments and interbedded volcanics occurs about 10 miles to the north-east. Whether or not these rocks once extended into the Region and have since been removed by erosion is unknown.

There is evidence, however, of an extensive pre-Lower Cretaceous erosion surface in south-eastern Australia and it is likely that this surface extended over most, if not all of the Region. It is also possible that this surface started to develop in the later Devonian and continued to form, with modifications due to epeirogenic movements, faulting and climatic variations, well into Mesozoic times. It may consist therefore of several individual surfaces, but insufficient work has been been done to determine whether or not this is so.

Cretaceous Tectonic Activity and Sedimentation

Renewed tectonic activity, which probably started in the Upper Jurassic but reached its peak in the Lower Cretaceous, resulted in a new dominantly E.-W. tectonic trend being superimposed on the general N.-S. trend of the Palaeozoic rocks. This new tectonic style has had a greater over-all effect on the gross morphology of Victoria than any other single event.

These movements produced extensive E.-W. depressions across southern Victoria and were accompanied by broad parallel upwarping to the north which initiated the Eastern Highlands (Hills, 1940). Sediment eroded from the rising land to the north, and possibly also from the south, was deposited in the subsiding troughs. There must also have been some volcanic activity at this time as some of the sediments are tuffaceous, but the source of this material is unknown. As far as the present land area is concerned, there are two of these troughs separated by the ridge of Palaeozoic rocks forming the Mornington Peninsula (Fig. 2).

In Gippsland, a thickness of 9,000 ft of Lower Cretaceous sediments has been proved by drilling, and the total thickness may be much greater. The sediments appear to have been deposited entirely under fresh-water conditions and no major breaks have been detected in the sequence in Gippsland, implying regular subsidence during deposition.

The sediments consist of arkoses, felspathic mudstones and shales, some of which are tuffaceous (Edwards and Baker 1943, Philip 1958, Jenkin 1962). Bituminous coal seams occur in places, as at Wonthaggi (Edwards, Baker and Knight, 1944) and Korumburra, and plant remains are common throughout (Medwell 1954, Douglas 1969). A remarkable fresh-water fish and insect fauna has been found at Koonwarra near Leongatha but, apart from this, animal remains are rare.

Around the margins of the basin, particularly in the Tyers area, at San Remo and on French Island, conglomerates derived from adjacent Palaeozoic rocks occur (Philip 1958, Jenkin 1962). At Rhyll on Phillip Island there is a distinctive coarse arkose (Rhyll Arkose) derived from the Woolamai Granite which lies immediately to the south (Edwards 1945, Jenkin 1962).

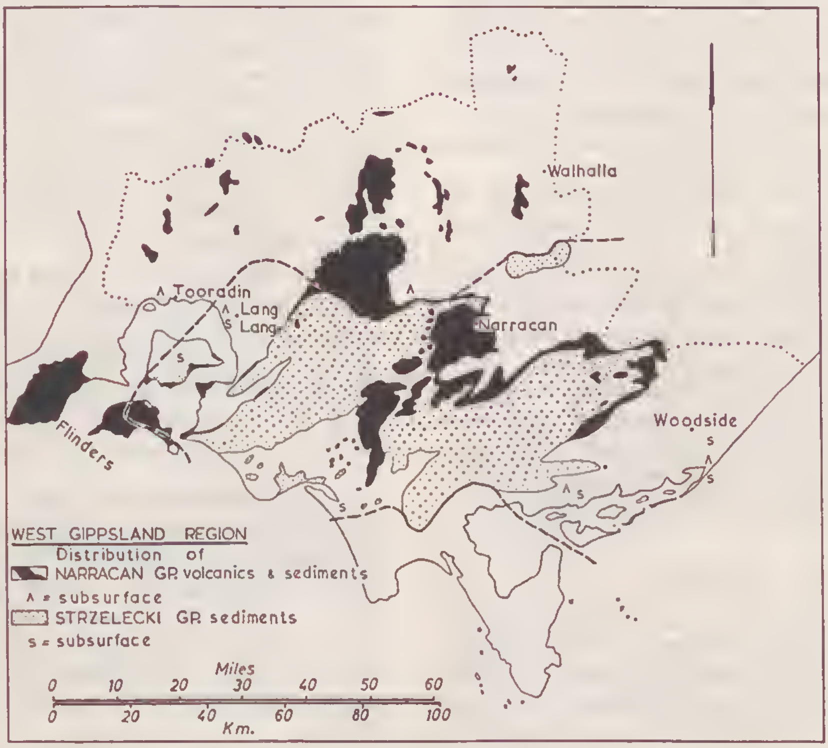

Fig. 2

There is still much uncertainty concerning the conditions under which these sediments were deposited. Lacustrine and flood plain deposition have each been separately postulated (Philip 1958, Singleton 1967b), but both types may be involved. Douglas (1969) has suggested that the initial deposition could have been lacustrine and the occurrence of thick intraformational mudstone conglomerates in the lower part of the sequence supports this contention. However, the presence of rootlet horizons and the xeromorphic nature of much of the flora higher in the sequence indicate that the surface was not continuously water covered.

The Lower Cretaceous rocks contain numerous micro- and macro-floral remains which have been documented principally by Dettman (1963) and Douglas (1969). An age range from perhaps Upper Jurassic to Albian has been suggested, but many uncertainties still remain concerning the accurate dating of the deposits and the environments of the floras.

CAINOZOIC EVENTS

Early Tertiary Sedimentation

Upper Cretaceous rocks are absent from Gippsland and the next deposits of which there is any record are early Tertiary, possibly Eocene, in age. They rest, often unconformably, on a surface cut in the Lower Createaceous sediments as well as on older rocks. Thus, in Upper Cretaceous and very early Tertiary times earth movements occurred which uplifted and tilted the Lower Cretaceous rocks. These events were accompanied by considerable erosion which produced the surface on which the later sediments were deposited.

In the north, now the Eastern Highlands, the country was undulating to hilly and gravels, sands and clays were deposited in the valleys. To the south the topography was more subdued and the sediments tended to form extensive sheets containing swampy depressions in which plant matter, now coal, accumulated—the Childers Formation and its equivalents (Thomas and Baragwanath, 1949-50). There is a tendency for these sediments to be thickest in parts of areas which are now downfaulted, suggesting that some downwarping had already commenced (Jenkin, 1962, 1968).

Early Tertiary Vulcanicity

Following the first phase of Tertiary deposition widespread vulcanicity occurred, with the eruption of vast quantities of basalt, agglomerate and tuff. Activity was intermittent as sediments are interbedded with the volcanics in many places. Appreciable faulting must also have occurred at this time, as very thick, but relatively local, volcanic sequences accumulated, for example in the Moe Sunkland, and at Flinders where the volcanics are at least 1,300 ft thick. The Flinders sequence contains extensive red horizons which appear to have been produced by subaerial weathering and may well be soils (red boles). Consequently, it has been suggested that the activity was intermittent and the area periodically subsiding (Jenkin, 1962).

In the higher land to the north (Baragwanath, 1925) and in the northern part of the Mornington Peninsula the flows were largely confined to valleys, but in the adjoining, more subdued country they coalesced to form extensive sheets.

Coal Measure Deposition

Following the extrusion of the volcanics and even in the dying phases, tectonic activity continued. Along prominent lineaments, particularly those defining the edges of major sunklands, the volcanics and associated sediments are often tilted at a high angle. In the sunklands, particularly in the Latrobe Valley and Gelliondale areas, extensive bodies of fresh-water sediments containing very thick brown coals were deposited in favourable situations. The coal measure sediments appear to lie conformably on the older sediments and volcanics within the sunklands, but at the margins they exhibit an unconformable relationship to the older Tertiary rocks. For this reason, combined with the fact that the coal seams thin and split towards the marginal structures (Thomas and Baragwanath, 1949-50), it is undoubted that some movement must have continued during the deposition of the coal measures. In addition, appreciable subsidence would have been necessary to accommodate at least 2,000 ft of sediment which accumulated.

In the Latrobe Valley there are several major seams normally separated by beds of clastic sediments, usually fine-grained. Rarely, these splits are absent giving a total continuous coal thickness of over 600 ft. In Western Port, on the other hand, the coal seams are thin, and clastic sediments, mainly clays and sands, predominate (Fig. 3).

The age of the coal measures is still a subject for controversy but it is likely that they span the Oligocene and extend into the Lower Miocene. In East Gippsland they intertongue with at least the lower part of the marine Tertiary rocks, although Carter (1964) denies this, and in Western Port, a similar intertonguing with early Miocene marine deposits has been demonstrated (Keble, 1954).

The subdivision of the coal measures is shown in Table I and has been described in some detail by Thomas and Baragwanath (1949-50) and by Gloe (1960).

The mid-Tertiary Marine Transgression

The marine transgression which appears to be contemporaneous in part with the coal measures, started in the Oligocene with the deposition of the Lakes Entrance Formation and reached its maximum in the Lower to Middle Miocene Gippsland Limestone Formation and its equivalent, the Sherwood Marl, in Western Port. A regressive phase started in the Upper Miocene (Tambo River Formation) and continued into the Lower Pliocene (Jemmy's Point Formation). Since Lower Pliocene times there have been minor advances and retreats of the sea and marine and terrestrial deposits are intertongued in southern and eastern Gippsland.

The limits of the Tertiary marine rocks are shown in Fig. 3. In the West Gippsland Region there is little outcrop of these deposits and most of the information concerning them has come from bore data.

The Return to Terrestrial Conditions

In Western Port and on the Mornington Peninsula, during Upper Miocene times, terrestrial deposition spread over a wide area producing the Baxter Sandstone and its equivalents. This formation consists of ferruginous sands and clays with fine gravels prominently developed near the highland margins of the deposits. It is considered that the Baxter Sandstone was deposited as a series of coalescing alluvial fans adjacent to the highlands which merged into a broad flood plain in the lower country (Keble 1950, Jenkin 1962, Gostin 1966).

Equivalents of the Baxter Sandstone have not been recognized to the east of the South Gippsland Highlands. Their place is taken by the regressive marine sediments already mentioned, but it is possible that the terrestrial sediments overlying the Tertiary marine deposits in East Gippsland could in places extend back into the Upper Miocene.

In East Gippsland, following the retreat of the Lower Pliocene sea, gravels, sands and clays with occasional thin seams of brown coal were deposited. These deposits, the Boisdale Beds and their equivalents, are best developed to the east of the Region, but also occur in the Alberton area and probably in Western Port. Beds deposited in depressions in the coal surface at Morwell may also be equivalent (Jenkin, 1968).

The Kosciusko uplift

Towards the end of the Pliocene, earth movements were renewed and reached their maximum intensity in late Pliocene to early Pleistocene times. The Eastern Highlands reached their maximum height at this time and, to the south, movement was renewed on structures which had been active earlier in the Tertiary. Erosion was accelerated as a result of the increased elevation of the highlands and may also have been influenced by

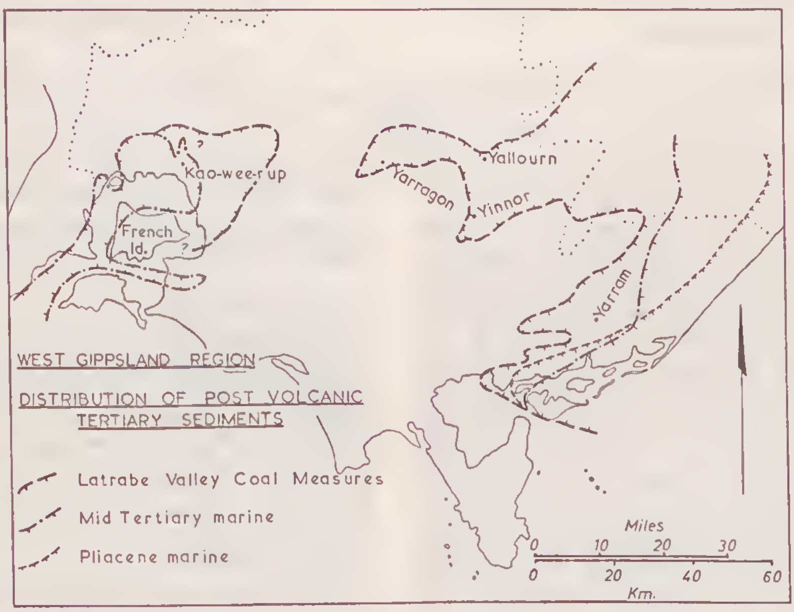

Fig. 3

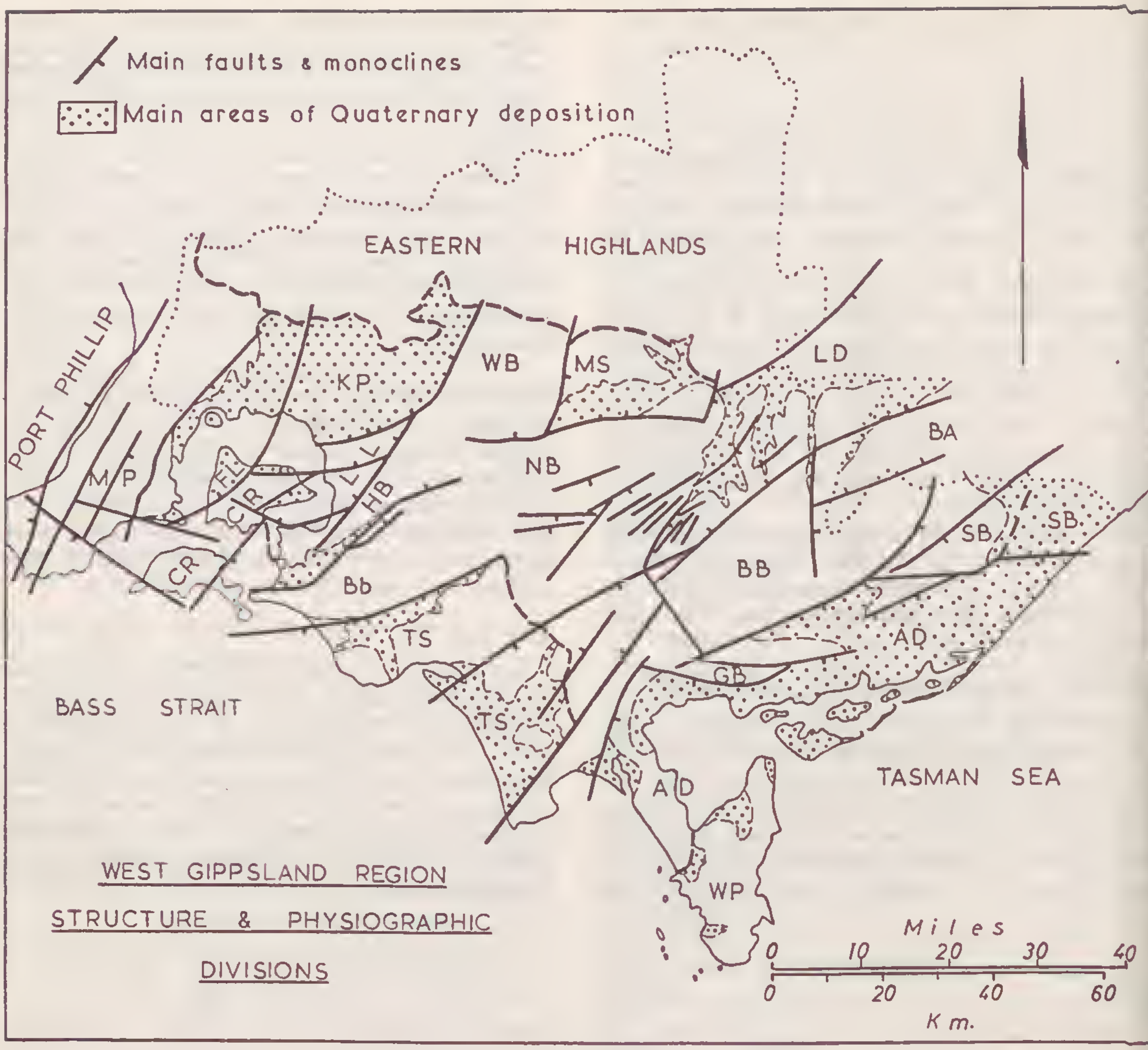

FIG. 4

climatic change. The derived material was deposited as fans and aprons of gravel, sand and clay along, and spreading out from, the structural scarps. These deposits in the central Gippsland area have been called the Haunted Hill Gravels by Thomas and Baragwanath (1949-50) and have extensive equivalents within and south of the South Gippsland Highlands. The Grantville Gravels in Western Port are of similar appearance and approximate age. However, strict contemporaneity of all these deposits is unlikely because of their close relationship to faults and monoclines which were probably moving at different times over the period from mid-Pliocene to early Pleistocene. Earth movements continued into the later stages of deposition, warping the sediments up onto the flanks of the highlands and depressing them beneath the floors of the sunklands (Hills 1940, Jenkin 1968). Earth movement waned in the earlier part of the Pleistocene although minor activity has continued up to the present time.

The Quaternary

The Quaternary era is characterized by oscillating marine, terrestrial and intermediate conditions resulting from eustatic and tectonic movements. The erosional and depositional surface produced in the late Pliocene and early Pleistocene was differentially warped by the continuing, but waning, Kosciusko movements and was partially inundated by the sea which produced sand barriers and bars.

The subsequent regressions and alternating advances of the sea resulted in the formation of

TABLE 2

WEST GIPPSLAND REGION—PHYSIOGRAPHIC UNITS (cf. Fig. 4)

EASTERN HIGHLANDS	Deeply-dissected plateau reaching 4,500 ft, with higher residuals. Structural and stratigraphic control of erosion pronounced.
SOUTHERN UPLANDS	
(a) Mornington Peninsula (MP)	Dissected ridge of Palaeozic with flanking Tertiary rocks Reaches 1,000 ft in S. but falls to about 100 ft in N.
(b) South Gippsland Highlands (i) *Warragul Block* (WB) (ii) *Narracan Block* (NB)	Maturely dissected block faulted area of initial low relief. Mainly 500 to 2,500 ft.
(iii) *Tarwin Block* (iv) *Balook* (BB) *and Gelliondale Block* (GB) (v) *Heath Hill* (HB) *and Bass Block* (Bb)	
(vi) *Baragwanath Anticline* (BA)	Broadly-arched area becoming narrower and lower towards the east (1,000 ft to 100 ft.).
(vii) *Wilsons Promontory* (WP)	Rugged terrain with peaks reaching 2,475 ft.
WESTERN PORT SUNKLAND	
(a) Kooweerup Plain (KP)	Generally low-lying. Alluvial fan and flood plain deposits; aeolian sands in W., extensive swamps in central area; salt marsh and mangrove fringe.
(b) Lang Lang Lowlands (LL)	Undulating to slightly hilly group of tilt blocks of relatively low elevation.
(c) Bass Plain	Flood plain and delta of the Bass River.
(d) French Island Lowlands (FL)	Predominantly low lying area of sand ridges with intervening swamps and lakes. Salt marsh and mangrove fringe in places.
(e) Central Ridge (CR)	Relatively high group of upthrown blocks with a core of Mesozoic sediments and Tertiary Volcanics.
GIPPSLAND SUNKLANDS	
(a) Latrobe Depression (LD) and Moe Swamp (MS)	Broad alluviated valleys with lateral terraces; extensive swamps.
(b) Stradbroke Block (SB)	Coastal terraces with sand ridges.
(c) Alberton Depression (AD) (d) Tarwin Sunkland (TS)	Coastal terraces and sand barriers; alluvial flats and swamps.

high-level marine and fluviatile terraces with related deposits. The chronology of the high terraces has not been studied in detail within the Region. However, they are of wide occurrence in the Western Port, Tarwin and Woodside areas.

In the country between Corner Inlet and Woodside there is a well-defined series of cliffs, terraces and barriers representing periods of still-stand, each followed by a retreat of the sea. The principal levels are at +45 to 50 ft, +25 ft, +18 ft and +10 ft. The lower of these terraces still shows traces of former tidal channels (Jenkin, 1968).

In the late Quaternary the sea fell well below its present level, which resulted in a marked deepening of the river valleys. The subsequent rise in sea level, which reached a maximum height of about +10 ft in the mid-Recent, caused infilling of the valleys with estuarine and alluvial deposits and the development of extensive sand barriers on the gently-shelving areas adjacent to or just off-shore. Examples of such barriers are the Corner Inlet islands, and Sandy, Stockyard and Observation Points in Western Port.

Finally, sea level became adjusted to its present position and was accompanied by marine and fluviatile activity marked principally by the development of the outer barrier near Corner Inlet, the growth of extensive salt marshes in Corner

Inlet, Western Port and other inlets and alluviation, particularly in the lower reaches of the main streams.

TECTONIC CONTROL OF THE GROSS MORPHOLOGY

This brief survey of the geological history of West Gippsland shows that the factors influencing the large-scale geomorphic development of the Region are chiefly tectonic and can be traced back to Palaeozoic times, although it is not until the Mesozoic that indications of the present configuration become apparent. The main outlines, however, were clearly defined by early Tertiary earth movements and accentuated by strong movements in the late Pliocene and early Pleistocene.

The physiographic units (Fig. 4) are therefore basically morphotectonic and are bounded, in most cases, by normal faults or monoclines. A brief description of these units is set out in Table 2.

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